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WEST INDIAN FORMS OF THE FLYING FISH, GENUS *CYPSELURUS*, WITH THE DESCRIPTION OF A NEW SPECIES

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In 1928,[1] Nichols and Breder described *Cypselurus monroei*, on the basis of a single young fish 48 mm. in standard length, taken at Cocoanut Grove, Florida. This fish presented some novel differences from other more usual forms of *Cypselurus*. An adult of the same species has recently come into the writers' hands, along with three other flying-fishes collected by Mr. J. G. Smith in 1929, who also kindly supplied the locality data with the specimens.[2] These were brought north in a refrigerated condition and still showed their life colors to a considerable degree. They may be considered by species.

Cypselurus monroei Nichols and Breder

The proportional measurements show surprisingly slight differences between the juvenile type of the species and the present adult specimen (Fig. 1),[3] the description of which follows.

Standard length, 151 mm.; total length, 200 mm.; Sept. 30, 1929; south of Dry Tortugas, Fla.

Head in length, 4.2; depth, 6.0. Dorsal, 13½; anal, 9½. Eye in head, 3.3; snout, 3.6. Lateral line, 56; predorsal scales, 35. Interorbital in head, 3.0; maxillary, 4.0; width of head, 2.0; greatest width of body, 1.9; depth of peduncle, 3.2; barbel, 1.2; lower caudal lobe, 0.7; longest dorsal ray (fifth), 1.5; anal ray (third), 2.7. Pectoral in length, 1.4; ventral, 2.9.

Body not so quadrate as in other species of *Cypselurus* nor so eliptical as in *Parexocætus;* head narrowed forward and relatively pointed. Ventrals inserted midway between edge of preopercle and base of caudal and midway between tip of upper caudal lobe and tip of lower jaw, with mouth open; dorsal inserted at two-thirds the distance from anterior margin of pupil to caudal base; anal origin behind dorsal origin a distance equal to two-thirds of eye; midway between tip of lower caudal lobe and end of pectoral base. Pectorals reach to scarcely beyond dorsal base; ventrals to scarcely beyond anal base. Dorsal height, 1.2 in dorsal base which is 1.2 in head;

[1] Nichols, J. T., and Breder, C. M., Jr., 1928, 'An annotated list of the Synentognathi, with remarks on their development and relationships.' Zoologica, VIII, No. 7, June 11, p. 432.

[2] These fishes flew aboard the tanker 'Airo,' those of September 30 following a typical fall hurricane.

[3] Figs. 1 to 4, inclusive, have been prepared by Miss Jean Roddan of the N. Y. Aquarium staff.

anal height, 1.8 in anal base which is 2.0 in head. A long, simple, fleshy, tapering barbel at right of symphysis (the left one was obviously lost and the scar healed). The right barbel is eliptical in section, pale-colored with a narrow dark fluted membrane on either side, Palatines with fine teeth, vomer with none.

Color and Pattern on Ice.—Body bluish above and silvery below, very like *Cypselurus furcatus*. Pectoral membrane jet-black, except between the three innermost rays where it is white and from which radiates a small and scarcely evident area which is dark dusky. The rays are white and show through the membrane they overlay when viewed from above; they show as bright silvery white lines viewed from below. Ventrals white proximally, with the distal seven-tenths abruptly jet-black as though dipped in ink to that point, except for the outer edging of the fin which is white, and a light dusky line on the four first rays running to the axil, which is likewise dusky. Dorsal black, except for the bases of the first six rays which have a light spot about the diameter of eye. Anal clear, except for a light dusky blotch centrally somewhat smaller than the eye. Caudal mottled, dark dusky in ground color with the

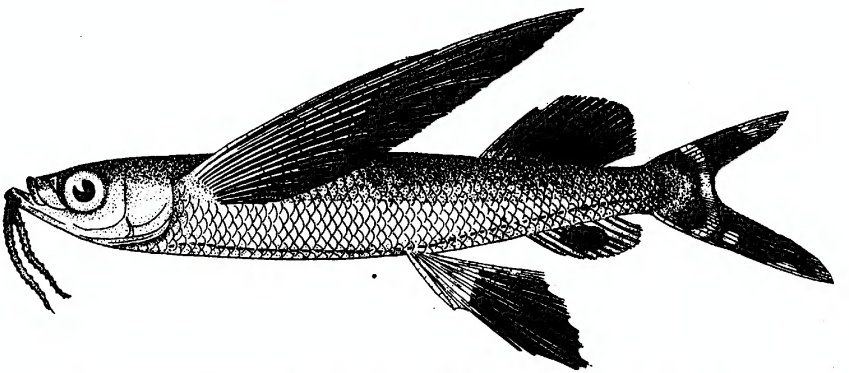

Fig. 1. *Cypselurus monroei* Nichols and Breder. Standard length, 151 mm.

tips of both lobes white and a band of light nearly at the fin's base which is convex backward and includes both lobes. On the lower lobe there is a light spot just behind this band and farther backward a second. The latter is at the lower edge of the fin.

This fish shows very definite evidences of primitive affinities: such as the high, dark dorsal fin which is nearly the size and form of that of *Parexocœtus;* the intermediate type of body cross-section; the sharpness of the snout; and possession of well-developed palatine teeth at this size. Considering these characters, it might be held as the most primitive of the genus, but along with these are other characters which might be taken to be the most specialized to be found in a *Cypselurus*. For example, even as an adult it retains large conspicuous and highly specialized barbels and a caudal pattern evidently related to that of a young *furcatus*, which is shown in Fig. 2 for comparison. This might be taken

simply as the retention of primitive larval characters, but, on other grounds which will be treated at another time, such larval characters in this group are believed to be specializations and a retention of them would consequently indicate a continuation of these more recently developed characters into adult life. Furthermore, the very young of the unquestionably more primitive *Parexocœtus* are in all essential respects similar to their adults at all ages.

A species of the Indian Ocean, *Cypselurus naresi* (Günther), known from three specimens of 60, 150, and 160 mm., is apparently close to *monroei*, but the current descriptions are inadequate to clearly determine just how close the resemblance may be. There is no mention in *naresi* of a marked resemblance to *Parexocœtus*, i.e., the elliptical body section, the high dorsal, the small ventrals, etc. It seems unlikely that they would pass unnoticed, if this fish resembled *monroei* in these striking characters. Other relative minor differences are listed below, and in themselves indicate specific distinction. Also, it is strange that a single barbel is mentioned only, and that in this single adult of *monroei* only one remains intact.

	Cypselurus naresi	*Cypselurus monroei*
Total Length (mm.)	60, 150, 175	200
Dorsal	10 to 12	13½
Lateral Line	45	56
Depth	6.5 to 7	6
Head in Total Length	4— to 5+	5.5
Eye	3	3.3
Eye in Post-orbital Part of Head	1±	1.5
Predorsal Scales	27 to 32	35
Ventrals	Black except on middle 4th, or black with inner border white	Black on distal ⅔
Anal	Last ⅓ black	With a central black blotch

A new genus could doubtless be erected for this species, combining as it does primitive and specialized characters, but at present it is considered best to let it stand as an aberrant *Cypselurus*, pending further data.

Cypselurus furcatus (Mitchill)

Standard length, 150 mm.; Sept. 30, 1929; south of Dry Tortugas, Fla.

The colors and pattern of this specimen are so like that of Fig. 175 of Nichols and Breder, showing a specimen of 160 mm. standard length, that comment is unnecessary. The largest barbel is 1.8 in the head, and black except at the base which is white.

Attention is called to the fact that the present specimens of *furcatus* and *monroei* differ by 1 mm., but the caudal patterns are very different, that of *furcatus* being plain dusky, while that of *monroei* resembles that of numerous specimens of *furcatus*, collected at the Carnegie Biological Station at the Dry Tortugas in the early summer of 1929, which ranged from about 60 to 100 mm. Above this size-range it fades to plain dusky, and below, it has not yet appeared.

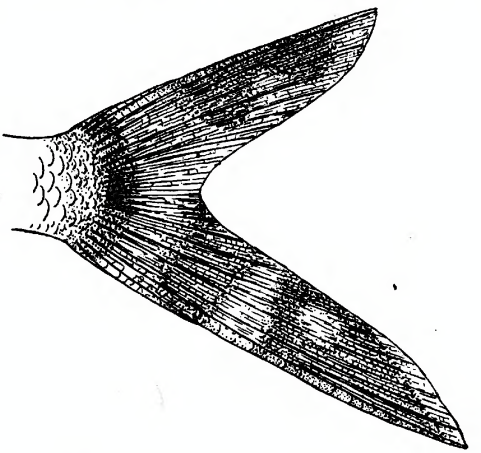

Fig. 2. Caudal of *Cypselurus furcatus* (Mitchill), 70 mm. standard length, showing resemblance of pattern to that of adult *C. monroei*. From a specimen taken at the Dry Tortugas Laboratory of the Carnegie Institution of Washington, D. C., July, 1929.

Cypselurus smithi, new species

TYPE.—No. 9673, American Museum of Natural History; north of Bahamas, Sept. 30, 1929. Standard length, 200 mm.; total length, 256 mm.

Head in length, 3.9; depth, 6.2. Dorsal, 15½; anal, 10½. Eye, in head, 3.2; snout, 3.3. Lateral line, 45; predorsal scales, 28. Interorbital in head, 3.0; maxillary, 3.9; width of head, 2.8; greatest width of body, 2.7; depth of peduncle, 3.3; lower caudal lobe, 0.8; longest dorsal ray (third), 1.8; anal ray (third), 3.8. Pectoral in length, 1.4; ventral 3.7.

Body quadrate, head blunt. Ventrals inserted midway between posterior margin of eye and caudal base, and midway between base of last anal ray and a point nearly a pupil's length in advance of gill-opening. Dorsal inserted two-thirds the distance from a point midway between anterior edge of eye and pupil and the caudal base. Anal behind dorsal by a distance equal to postorbital part of head, which is equal to snout to nearly center of pupil. Pectorals reach to root of upper caudal lobe, ventrals to first third of anal. Dorsal height, 1.7 in dorsal base which is 1.2 in head; anal height, 2.0 in anal base which is 2.2 in head.

COLORATION.—Pectorals with a diffused light band radiating from the inner edge of fin to about three-fourths the way across it. Membranes blue-black, the rays jet, the outer one whitish. Ventrals clear, with dusky rays, darkest proximally, most pronounced on the three central rays. Dorsal clear, with a triangular black distal area on the membranes posteriorly not quite reaching to the base of the fin forward to the ninth ray, its front margin thence vertically upward to the tip of the fourth. A paler dusky spot in this area between ninth and tenth rays. Anal fin is plain. Lower caudal lobe black, upper whitish with a dusky outer margin. This mark is most pronounced in contrast to other similar flying fishes.

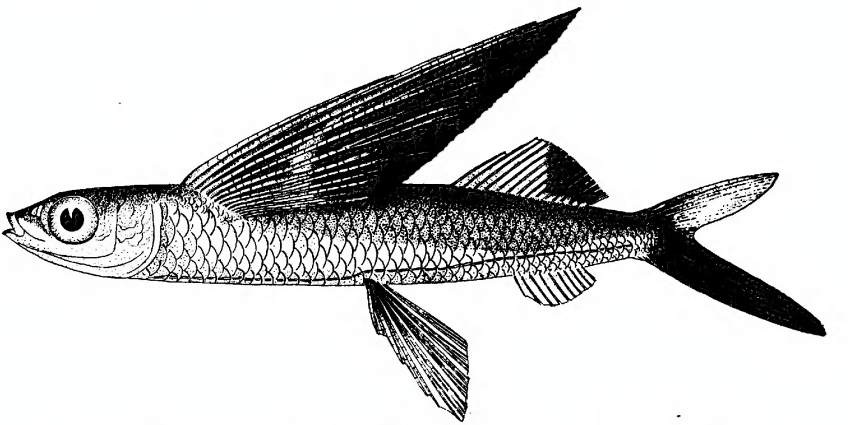

Fig. 3. *Cypselurus smithi*, new species. Standard length, 200 mm. Type.

Named for the collector, Mr. J. G. Smith.

There is one paratype of 151 mm. standard length, Diamond shoal light, Sept. 19, 1929, which is similar to the type except in the following respects: dorsal, 14; ventrals reach nearly to end of anal, inserted midway between base of caudal and posterior edge of pupil, or between end of anal base and middle of opercle. In the ventral, the central three rays are black on the distal half and nearly white proximally. The two outer rays are light dusky for their entire length.

This is a well-marked fish somewhat similar to *C. bahiensis*. Compared with *C. bahiensis*[1] of comparable size, they may be separated according to the following tabulation.

[1]Based on specimens identified by Breder, 1927, Bull. Bing. Ocean. Coll., I, Art. 1, pp. 22–23.

Cypselurus bahiensis	*Cypselurus smithi*
Caudal lobes both dusky	Upper lobe, whitish, lower black
Dorsal with black blotch	Dorsal posteriorly black
Pectorals all dark	Pectorals with light bar
Ventrals inserted midway between base of caudal and edge of preopercle, or midway between end of anal base and middle of pectoral base	Ventrals inserted midway between base of caudal and eye to pupil, or midway between posterior margin of end of anal base and edge or middle of opercle
Eye, 3.4—3.5	Eye, 3.2

Cypselurus lutkeni Jordan and Evermann

A specimen of *Cypselurus lutkeni* taken by Mr. Clarence R. De Sola off Cayos de Santo Maria, north coast of Cuba, 22° 41′ N., 75° 55′ W., April, 1, 1929,[1] may be described as follows.

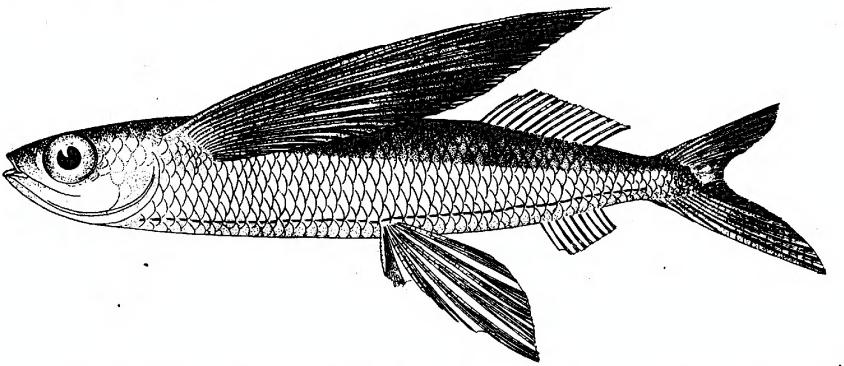

Fig. 4. *Cypselurus lutkeni* Jordan and Evermann. Standard length, 241 mm.

Standard length, 241 mm.; total length, 284 mm. Head in length, 4.2; depth, 5.8. Dorsal, 13; anal, 9. Eye in head, 3.0; snout, 3.5. Lateral line, 50; predorsal scales, 32. Interorbital in head, 3.5; maxillary, 4.8; width of head, 1.9; greatest width of body, 1.8; depth of peduncle, 3.6; lower caudal lobe, 0.8; longest dorsal ray (second), 2.5; anal ray (third), 3.7. Pectoral in length, 1.4; ventral, 3.1.

Body quadrate, head blunt. Ventrals inserted midway between posterior margin of eye and caudal base, and midway between base of last anal ray and insertion of pectoral; dorsal inserted at two-thirds the distance from center of eye to caudal base; anal origin behind dorsal origin a distance equal to snout; a little nearer caudal base than ventral insertion. Pectorals reach nearly to tip of depressed last dorsal ray; ventrals barely to base of last anal ray. Dorsal height, 1.9 in dorsal base which is 1.3 in head; anal height, 1.6 in anal base which is 2.4 in head.

Coloration in Alcohol.—Pectoral rays dusky, except at tips where they are white. Membranes clear, except at their distal third and between first six rays

[1]Flew aboard the molasses freighter S.S. 'Castana.'

proximally. Ventrals plain, except for first three rays faintly dusky. Caudal uniform dusky. Dorsal slightly dusky; anal plain.

This description is not in complete agreement with that of the type, but the differences are such as to be within probable limits of individual variation and expected change with size, as the type was 9 inches (217 mm.) as against 284 mm. in length. There is nothing about this fish, however, that suggests in any way that *lutkeni* is not a perfectly valid species.

This species is certainly close to *C. vitropinna* Breder,[1] but differs distinctly in the following characters.

Cypselurus lutkeni	*Cypselurus vitropinna*
Standard Length, 241 mm.	Standard Length, 172 mm.
Ventral insertion midway between base of caudal and posterior margin of eye and midway between end of anal base and insertion of pectoral	Ventral insertion midway between base of caudal and a point short of the preoperculum and midway between end of anal base and pectoral axil
Lateral line, 50	Lateral line, 46
Predorsal scales, 32	Predorsal scales, 27
Eye, 3.0	Eye, 3.3

It is to be noted that the smaller eye is in the smaller fish. Aside from these differences there are others which, however, would not be conclusive. The pectoral patterns are different, but possibly these change with age. The jaw teeth of *C. vitropinna* are nearly three times as large as those of *lutkeni*.

Jaw Teeth of the West Indian *Cypselurus*

Figure 5 illustrates a single tooth from the upper and lower jaw of each species discussed herein. Those forms which are apparently most closely related have the most nearly similar teeth. Thus, teeth of *C. heterurus*, *lutkeni*, and *vitropinna* all have cusps, and the others lack them. If we divide the average of the tooth-lengths by the standard lengths of the fish, we get a rough idea of relative size of teeth, which is very different from one species to another.

U. = Length of average tooth from upper jaw, measured from tip to base, in mm.
L. = Length of average tooth from lower jaw, measured from tip to base, in mm.
S.L. = Standard length of fish (tip of snout to end of last caudal vertebræ in mm.)

[1] 1927, Bull. Bing. Ocean. Coll., I, Art. 1, p. 21.

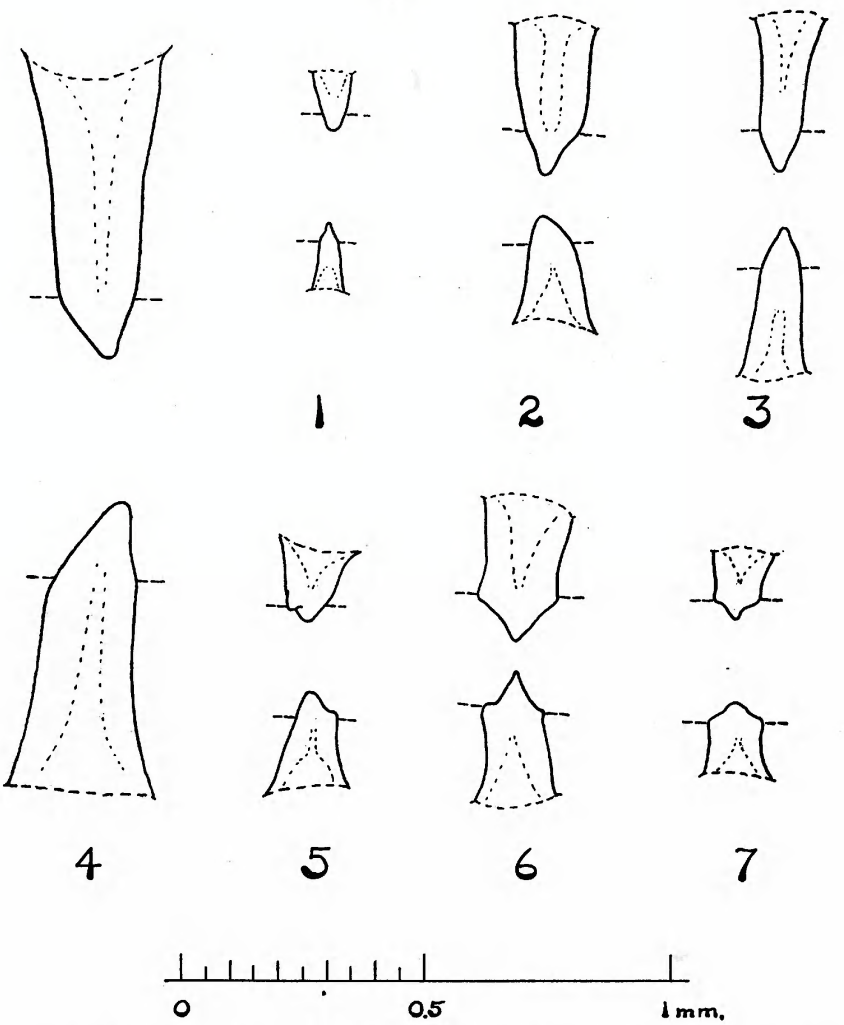

Fig. 5. Upper and lower jaw teeth of *Cypselurus*. Camera-lucida drawings of teeth taken from near symphysis.

1. *C. furcatus*, 150 mm. 2. *C. smithi*, 200 mm. 3. *C. monroei*, 151 mm. 4. *C. bahiensis*, 240 mm. 5. *C. lutkeni*, 241 mm. 6. *C. vitropinna*, 172 mm. 7. *C. heterurus*, 191 mm.

$$\text{Ratio} = \frac{\frac{1}{2}(\text{U.} + \text{L.})}{\text{S. L.}}$$

	U.	L.	S.L.	Ratio
Cypselurus furcatus	.13	.14	150	0.00090
" *monroei*	.34	.32	151	0.00211
" *smithi*	.33	.20	200	0.00132
" *bahiensis*	.61	.57	240	0.00246
" *heterurus*	.15	.14	191	0.00060+
" *vitropinna*	.30	.27	172	0.00165+
" *lutkeni*	.14	.18	241	0.00068

The ratios of these figures serve as another means of separating the species. For example, the teeth of *C. vitropinna* are nearly three times as long as either *lutkeni* or *heterurus*, those of *monroei* twice as long as *furcatus*, and *bahiensis* twice as long as *smithi*. The presence of cusps probably represents a real genetic relationship. It is noted that the pulp cavities also show characteristic variations.

Number of Species of *Cypselurus*

That, at this late date, four specimens of the genus *Cypselurus*, collected in a short time in much-frequented West Indian waters, add so much to our knowledge, requires some comment. The four specimens (and one other) may be listed as follows:

Cypselurus smithi	2 specimens	1 new species
Cypselurus lutkeni and *Cypselurus monroei*	2 specimens	2 species known from 1 specimen each
Cypselurus furcatus	1 specimen	1 well-known species

It would appear from this that a greater number of species are frequent in West Indian waters than has been generally supposed. Much of the literature containing keys of these fishes will place under one name what comparative material shows to be more than one form. Thus, the usual paucity of material in the hands of an ichthyologist at any one time, with such keys to work from, has doubtless kept alive the impression that the species of this genus were not numerous, adding to the general confusion concerning their status. It has been the bringing together, and noting the actual differences in a good many specimens from different localities and collections, that has made this condition patent. That it is not a matter of "hair-splitting" is evident from the very considerable and real differences in the present descriptions.